

ABSTRACT

Title of thesis: PERCEIVED DISCRIMINATION AND
MULTIMORBIDITY AMONG MIDDLE-AGED
AND OLDER ADULTS

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Multimorbidity, the presence of multiple chronic conditions,¹ is increasingly recognized by researchers as a major health priority. Relative to younger adults, the burden is much higher among middle-aged and older adults with prevalence estimates ranging from 25-98%.²⁻⁵ Variations in the burden of multimorbidity within the aging population exist with a growing body of research showing racial/ethnic differences in the incidence, prevalence, and severity of multimorbidity.^{2,6} This study analyzed the association between perceived racial discrimination and multimorbidity among middle-aged and older adults and whether or not existing associations vary by race/ethnicity. Findings show that individuals reporting perceived discrimination are more likely to have multimorbidity. While racial/ethnic differences in the association between perceived discrimination and multimorbidity were not observed, Black respondents displayed the greatest risk for multimorbidity. Perceived discrimination may provide insight into why multimorbidity varies by race/ethnicity through the mechanisms of stress responses and health behaviors.⁷

PERCEIVED DISCRIMINATION AND MULTIMORBIDITY AMONG
MIDDLE-AGED AND OLDER ADULTS

by

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TABLES

Table 1: Descriptive characteristics of the study population

Characteristic	N (total)	% of study population
Total	12,250	100
<u>Race/Ethnicity</u>		
Non-Hispanic White	8189	66.9
Non-Hispanic Black	2117	17.3
Non-Hispanic Other	442	3.6
Hispanic	1488	12.2
<u>Age (mean, SD)</u>	69.1, 10.5	-
<u>Sex</u>		
Male	4970	40.6
Female	7280	59.4
<u>Educational Attainment</u>		
Less than high school (HS)	1769	14.4
GED/HS	4134	33.8
More than HS	6345	51.8
<u>Income (mean, SD)</u>	74480.77, 114376.94	-
<u>Marital Status</u>		
Currently married/partnered	7573	61.8
Not currently married/partnered	4675	38.2
<u>BMI</u>		
Normal Weight	2557	20.9
Overweight	4074	33.3
Obese	4466	36.5
BMI Unknown	1153	9.4
<u>Health Insurance Status</u>		
Insured	11841	96.7
Uninsured	398	3.3
<u>Smoking Status</u>		
Never smoked	5551	44.8
Former smoker	5006	40.1
Current smoker	1632	13.2
<u>Physical Activity Status</u>		
Active	11937	97.7
Inactive	277	2.3

Table 2: Distribution of participant characteristics by occurrence and type of perceived discrimination

	Perceived General Discrimination				Perceived Attributed Discrimination			
Characteristic		1 (experienced discrimination)	2 (never experienced discrimination)	p-value	1 (racial discrimination)	2 (non-racial discrimination)	3 (no discrimination)	p-value
		No., %	No., %	-	No., %	No., %	No., %	-
Total	12,250	7686 (62.7)	4564 (37.3)	-	1900 (15.5)	4746 (38.7)	5604 (45.7)	-
<u>Race/Ethnicity</u>								
Non-Hispanic White	8189	5106 (62.4)	3083 (37.7)	<.0001	377 (4.6)	3819 (46.7)	3993 (48.8)	<.0001
Non-Hispanic Black	2117	1448 (68.4)	669 (31.6)		978 (46.2)	405 (19.1)	734 (49.3)	
Non-Hispanic Other	442	324 (73.3)	118 (26.7)		160 (36.2)	147 (33.3)	135 (30.5)	
Hispanic	1488	799 (53.7)	689 (46.3)		381 (25.6)	373 (25.1)	734 (49.3)	
<u>Age (mean, SD)</u>	69.1, 10.5	67.9, 10.3	71.2, 10.5	<.0001	64.8, 9.4	68.4, 10.4	71.2, 10.5	<.0001
<u>Sex</u>								
Male	4970	3244 (65.3)	1726 (34.7)	<.0001	824 (16.6)	1908 (38.4)	2238 (45.0)	.0256
Female	7280	4442 (61.0)	2838 (39.0)		1076 (14.8)	2838 (39.0)	3366 (46.2)	
<u>Educational Attainment</u>								
Less than high school	1769	947 (53.5)	822 (46.5)	<.0001	308 (17.4)	537 (30.4)	924 (52.2)	<.0001
GED/High School	4134	2546 (61.6)	1588 (38.4)		570 (13.8)	1601 (38.7)	1963 (47.5)	
More than HS	6345	4191 (66.1)	2154 (34.0)		1021 (16.1)	2607 (41.1)	2717 (42.8)	
<u>Income (mean, SD)</u>	74480.77, 114376.94	76898.91, 116621.16	70415.78, 110395.02	.0010	59662.28, 75620.19	79943.41, 117838.74	74856.61, 121632.89	.0011
<u>Marital Status</u>								
Married/partnered	7573	4717 (62.3)	2856 (37.7)	.1899	1060 (14.0)	2949 (38.9)	3564 (47.1)	<.0001
Not married/partnered	4675	2967 (63.5)	1708 (36.5)		840 (18.0)	1795 (38.4)	2040 (43.6)	
<u>BMI</u>								
Normal Weight	2557	1493 (58.4)	1064 (41.6)	<.0001	272 (10.6)	973 (38.1)	1312 (51.3)	<.0001
Overweight	4074	2509 (61.6)	1565 (38.4)		558 (13.7)	1541 (37.8)	1975 (48.5)	
Obese	4466	2850 (63.8)	1616 (36.2)		787 (17.6)	1768 (39.6)	1911 (42.8)	
BMI Unknown	1153	834 (72.3)	319 (27.7)		283 (24.5)	464 (40.2)	406 (35.2)	
<u>Health Insurance Status</u>								
Insured	11841	7405 (62.5)	4436 (37.5)	.0051	1787 (15.1)	4598 (38.8)	5456 (46.1)	<.0001
Uninsured	398	276 (69.4)	122 (30.7)		111 (27.9)	146 (26.7)	141 (35.4)	
<u>Smoking Status</u>								
Never smoked	5551	3372 (60.8)	2179 (39.3)	<.0001	852 (15.4)	2059 (37.1)	2640 (47.6)	<.0001
Former smoker	5006	3153 (63.0)	1853 (37.0)		705 (14.1)	1981 (39.6)	2320 (46.3)	
Current smoker	1632	1123 (68.8)	509 (31.2)		337 (20.7)	683 (41.9)	612 (37.5)	
<u>Physical Activity Status</u>								
Active	11937	7496 (62.8)	4441 (37.2)	.2245	1854 (15.5)	4626 (38.8)	5457 (45.7)	.6072
Inactive	277	164 (59.2)	113 (40.8)		41 (14.8)	101 (36.5)	135 (48.7)	

Table 3: Distribution of participant characteristics by number of chronic conditions

Characteristic	N (total)	No. of Conditions			p-value
		0-1	2-3	4+	
		No. (%)	No. (%)	No. (%)	-
Total	12,250	3452 (28.2)	5733 (46.8)	3065 (25.0)	-
<u>Race/Ethnicity</u>					
Non-Hispanic White	8189	2276 (27.8)	3869 (47.3)	2044 (25.0)	<.0001
Non-Hispanic Black	2117	504 (23.8)	1019 (48.1)	594 (28.1)	
Non-Hispanic Other	442	170 (38.5)	173 (39.1)	99 (22.4)	
Hispanic	1488	498 (33.5)	664 (44.6)	326 (21.9)	
<u>Age (mean, SD)</u>	69.1, 10.5	64.2, 9.4	70.1, 10.3	72.8, 10.0	<.0001
<u>Sex</u>					
Male	4970	1474 (29.7)	2282 (45.9)	1214 (24.4)	.0109
Female	7280	1978 (27.2)	3451 (47.4)	1851 (25.4)	
<u>Educational Attainment</u>					
Less than high school	1769	355 (20.1)	803 (45.4)	611 (34.5)	<.0001
GED/High School	4134	991 (24.0)	1969 (47.6)	1174 (28.4)	
More than HS	6345	2105 (33.2)	2961 (46.7)	1279 (20.2)	
<u>Income (mean, SD)</u>	74480.77, 114376.94	103482.63, 147894.60	70299.10, 105224.57	49657.35, 73191.31	<.0001
<u>Marital Status</u>					
Currently married/partnered	7573	2438 (32.2)	3450 (45.6)	1685 (22.3)	<.0001
Not currently married/partnered	4675	1014 (21.7)	2281 (48.8)	1380 (29.5)	
<u>BMI</u>					
Normal Weight	2557	925 (36.2)	1138 (44.5)	494 (19.3)	<.0001
Overweight	4074	1208 (29.7)	1928 (47.3)	938 (23.0)	
Obese	4466	786 (17.6)	2209 (49.5)	1471 (32.9)	
BMI Unknown	1153	533 (46.2)	458 (39.7)	162 (14.1)	
<u>Health Insurance Status</u>					
Insured	11841	3237 (27.3)	5582 (47.1)	3022 (25.5)	<.0001
Uninsured	398	212 (53.3)	146 (36.7)	40 (10.1)	
<u>Smoking Status</u>					
Never smoked	5551	1776 (32.0)	2626 (47.3)	1149 (20.7)	<.0001
Former smoker	5006	1192 (23.8)	2370 (47.3)	1444 (28.9)	
Current smoker	1632	471 (28.9)	705 (43.2)	456 (27.9)	
<u>Physical Activity Status</u>					
Active	11937	3422 (28.7)	5619 (47.1)	2896 (24.3)	<.0001
Inactive	277	27 (9.8)	98 (35.4)	152 (54.9)	

Table 4: Association between perceived general discrimination and multimorbidity

Characteristic	Model 1				Model 2			
	Multimorbidity (2-3 conditions)		Multimorbidity (4+ cond.)		Multimorbidity (2-3 cond.)		Multimorbidity (4+ cond.)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<u>Perceived General Discrimination</u>								
Yes	1.34	1.21, 1.49	1.61	1.43, 1.81	1.33	1.20, 1.47	1.62	1.43, 1.83
No	1.00		1.00		1.00		1.00	
<u>Race/Ethnicity</u>								
Non-Hispanic White	1.00		1.00		1.00		1.00	
Non-Hispanic Black	1.69	1.47, 1.94	2.19	1.87, 2.57	1.37	1.18, 1.58	1.46	1.23, 1.73
Non-Hispanic Other	0.76	0.58, 1.00	1.02	0.75, 1.40	0.86	0.65, 1.14	1.21	0.87, 1.68
Hispanic	1.13	0.97, 1.31	1.29	1.08, 1.55	1.10	0.85, 1.19	0.99	0.81, 1.21
<u>Age (mean, SD)</u>	1.07	1.06, 1.07	1.10	1.09, 1.10	1.07	1.07, 1.08	1.11	1.10, 1.12
<u>Sex</u>								
Male	1.00		1.00		1.00		1.00	
Female	1.13	1.02, 1.26	1.13	1.01, 1.27	1.16	1.05, 1.29	1.22	1.07, 1.39
<u>Educational Attainment</u>								
Less than high school					1.34	1.12, 1.60	2.08	1.71, 2.53
GED/High School					1.18	1.05, 1.32	1.50	1.32, 1.71
More than HS					1.00		1.00	
<u>Income (mean, SD)</u>								
<u>Marital Status</u>								
Married/partnered					1.00		1.00	
Not married/partnered					1.22	1.09, 1.36	1.33	1.17, 1.52
<u>BMI</u>								
Normal Weight					1.00		1.00	
Overweight					1.47	1.29, 1.67	1.79	1.52, 2.10
Obese					3.18	2.77, 3.64	5.89	4.98, 6.96
BMI Unknown					1.79	1.20, 2.66	2.97	1.85, 4.75
<u>Health Insurance Status</u>								
Insured					1.00		1.00	
Uninsured					1.81	1.34, 2.44	2.52	1.65, 3.85
<u>Smoking Status</u>								
Never smoked					1.00		1.00	
Former smoker					1.21	1.09, 1.35	1.63	1.43, 1.86
Current smoker					1.40	1.18, 1.65	2.59	2.14, 3.14
<u>Physical Activity Status</u>								
Active					1.00		1.00	
Inactive					1.49	1.06, 2.10	3.30	2.34, 4.63

Table 5: Association Between perceived attributed discrimination and multimorbidity

Characteristic	Model 1				Model 2			
	Multimorbidity (2-3 conditions)		Multimorbidity (4+ cond.)		Multimorbidity (2-3 cond.)		Multimorbidity (4+ cond.)	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<u>Perceived Attributed Discrimination</u>								
Racial	1.26	1.07, 1.48	1.64	1.36, 1.97	1.25	1.06, 1.47	1.67	1.38, 2.03
Non-Racial	1.50	1.34, 1.67	1.87	1.65, 2.13	1.45	1.30, 1.62	1.80	1.58, 2.06
None	1.00		1.00		1.00		1.00	
<u>Race/Ethnicity</u>								
Non-Hispanic White	1.00		1.00		1.00		1.00	
Non-Hispanic Black	1.75	1.50, 2.04	2.20	1.85, 2.62	1.41	1.20, 1.66	1.45	1.20, 1.75
Non-Hispanic Other	0.78	0.59, 1.03	1.02	0.74, 1.40	0.88	0.66, 1.16	1.18	0.85, 1.66
Hispanic	1.14	0.98, 1.33	1.29	1.07, 1.55	1.02	0.86, 1.21	0.97	0.79, 1.20
<u>Age (mean, SD)</u>	1.07	1.06, 1.07	1.10	1.09, 1.11	1.07	1.07, 1.08	1.11	1.10, 1.12
<u>Sex</u>								
Male	1.00		1.00		1.00		1.00	
Female	1.12	1.01, 1.23	1.12	0.99, 1.25	1.15	1.03, 1.28	1.20	1.06, 1.37
<u>Educational Attainment</u>								
Less than high school					1.34	1.12, 1.60	2.09	1.71, 2.55
GED/High School					1.18	1.06, 1.32	1.51	1.33, 1.73
More than HS					1.00		1.00	
<u>Income (mean, SD)</u>								
<u>Marital Status</u>								
Married/partnered					1.00		1.00	
Not married/partnered					1.21	1.08, 1.36	1.32	1.15, 1.50
<u>BMI</u>								
Normal Weight					1.00		1.00	
Overweight					1.48	1.30, 1.68	1.79	1.52, 2.11
Obese					3.15	2.75, 3.62	5.83	4.93, 6.90
BMI Unknown					1.78	1.20, 2.65	2.98	1.86, 4.76
<u>Health Insurance Status</u>								
Insured					1.00		1.00	
Uninsured					1.82	1.35, 2.45	2.55	1.67, 3.89
<u>Smoking Status</u>								
Never smoked					1.00		1.00	
Former smoker					1.21	1.09, 1.36	1.63	1.43, 1.85
Current smoker					1.39	1.18, 1.64	2.56	2.11, 3.11
<u>Physical Activity Status</u>								
Active					1.00		1.00	
Inactive					1.47	1.05, 2.06	3.22	2.29, 4.53

LITERATURE REVIEW

Multimorbidity Prevalence and Public Health Significance

Multimorbidity, defined as the presence of multiple chronic conditions in a single individual,¹ is increasingly recognized by researchers as a major public health and clinical priority. It is estimated that more than one in four U.S. adults has multimorbidity.³ Among middle-aged and older adults, the burden is likely higher, with estimates ranging from 25-98 percent.²⁻⁵

Multimorbidity, Disability, and Mortality

For many individuals, a diagnosis of multimorbidity results in poorer quality of life, increased psychological distress, and greater risk of disability and mortality.^{4,8,9} Patients experiencing multiple chronic conditions often have poorer health outcomes, such as declined physical and mental health functioning and frailty.¹⁰ Additionally, a greater burden of chronic conditions is strongly associated with both changes in daily life activities and disability.¹¹ Studies show multimorbidity is associated with increased risk of death, with disabilities mediating the effects of multimorbidity on mortality.¹⁰ In a 2016 review paper, Nunes et al. found that the risk of death was 1.73 and 2.72 for people with 2 or more and 3 or more chronic conditions, respectively, when compared to individuals without multimorbidity.¹⁰

Healthcare Utilization and Costs

Individuals with multimorbidity have greater health needs and ultimately require more healthcare utilization than those with one chronic condition or without any at all.¹² Those with multimorbidity need intricate, structured care plans rather

than specialized single disease treatment methods.¹³ In addition to more frequent regular primary care, multimorbidity has been associated with an increase in utilization of all healthcare services including visits to specialists, end-of-life healthcare, hospitalization frequency, and emergency department visits.¹⁴⁻¹⁷ In addition to the increased use of services by people with multiple illnesses, healthcare costs increase significantly with each additional chronic illness diagnosis.

Defining and Measuring Multimorbidity

The wide-ranging estimated prevalence of multimorbidity among middle-aged and older adults (25-98%.²⁻⁵) is due to the lack of consensus regarding the best way to measure multimorbidity. While many researchers define multimorbidity as the presence of two or more chronic conditions,^{2,4,8,12,17} some studies use different age groups, counts, and types of diseases. Variations in the different ways to measure multimorbidity can often be attributed to the methodological processes of individual studies. The number of diseases included in study calculations of multimorbidity are often dependent upon the data source used to conduct the study.

The Distribution of Multimorbidity across Age and Gender

While research regarding multimorbidity is advancing, some patterns have remained consistent in recent decades. Many studies conclude that multimorbidity is increasingly prevalent as populations age.^{9,14,18} Globally, those aged 65 and over comprise the majority of those affected by multimorbidity.^{1,9} With regard to gender, multimorbidity appears to be more prevalent among females.^{13,19-21}

The Distribution of Multimorbidity across Race/Ethnicity

While an extensive body of literature documents the disproportionate share of individual chronic disease morbidity and mortality for racial and ethnic minorities, research specific to multimorbidity is limited, but growing. Prior studies indicate racial/ethnic differences in the incidence, prevalence, and severity of multimorbidity.^{2,6} For example, Black populations have a disproportionately higher burden of multimorbidity in comparison to whites.^{5,6,22} Further, multimorbidity emerges earlier and progresses more rapidly in Black and Hispanic populations. More specifically, Quinones et al. found that on average, middle-aged black adults develop multimorbidity at an earlier age than their white counterparts with initial chronic disease counts that are about 40% higher than white respondents.²³ When accounting for age, Quinones et al. found that prevalence of multimorbidity was consistently higher in White and Black participants than Hispanic participants or participants of other races.²³

Risks for Multimorbidity

Certain risk factors have been associated with likelihood of developing multimorbidity. As stated, older age and being female have been found as prominent risk factors in multiple studies.^{9,21,24} Other factors related to the social determinants of health, the circumstances in which people live and the systems influencing the circumstances of daily living,²⁵ are known to be risk factors of chronic disease and can ultimately lead to the accumulation of multiple chronic diseases at once. While studies have found that adverse childhood experiences, low socioeconomic status, and neighborhood context are associated with a greater risk

of multimorbidity,^{5,6,17,18,22,23,26,27} these factors do not fully explain the observed racial/ethnic variations in multimorbidity. The social determinants of health partially explain racial health disparities in the United States, but consideration of the interplay of multimorbidity with the social determinants of health have received less attention.²⁸ Attention to psychosocial stressors that disproportionately impact racial and ethnic minorities may provide insight into why multimorbidity varies by race/ethnicity.

Discrimination and Health

Perceived discrimination is defined as subjective perceptions of unfair or unjust treatment based on personal characteristics.²⁹ Discrimination occurs at both systemic (large-scale situations that limit opportunities and resources of marginalized groups) and individual (adverse interactions between people based on personal traits) levels that influence how it is measured.³⁰ Everyday discrimination encompasses routine experiences of unfair treatment while major discriminatory events capture more significant experiences.³⁰ Research suggests that the persistence of racial health inequities may in part reflect unique psychosocial stressors, such as perceived discrimination, the unfair or unjust treatment based on personal characteristics (e.g., race/ethnicity, age, sex, sexual orientation).³¹

Perceived discrimination is related to both physical and mental health outcomes through the mechanisms of stress responses and health behaviors that can be compounded over time.^{7,32} The mechanisms linking perceived discrimination and health are hypothesized to operate via heightened physiological (i.e. stress), psychological (i.e. depression), and behavioral (i.e. maladaptive coping) responses

to have negative effects on physical and mental health outcomes.⁷ Perceived discrimination has been associated with increased risk of countless chronic conditions including type 2 diabetes and cardiovascular disease (specifically, myocardial infarction).^{33,34} Additionally, racial discrimination has been linked to low birth weight, hypertension, and poor self-reported health status.³⁵⁻³⁷

While the association between perceived discrimination and multimorbidity is not fully understood, it is possible that multimorbidity may operate through similar stress response mechanisms which may provide insight into why multimorbidity varies by race/ethnicity. Additional research is warranted to fully understand the role of perceived discrimination as a factor that contributes to racial/ethnic health differences in the patterning of multimorbidity.

Research Gaps

As a newer outcome within public health research, multimorbidity research is more limited than that of specific individual conditions. While sociodemographic, behavioral, and neighborhood characteristics have been found to be associated with increased risk of multimorbidity, the role of psychosocial stressors such as perceived discrimination are understudied. Prior studies suggest that perceived discrimination is linked to chronic conditions (e.g., high blood pressure and diabetes) via stress processes. However, few studies have tested whether perceived discrimination is associated with multimorbidity.

RESEARCH QUESTIONS AND HYPOTHESES

1. Is there an association between perceived discrimination and multimorbidity among middle-aged and older adults?

It is hypothesized that an association exists between perceived general discrimination and multimorbidity.

It is hypothesized that associations exist between perceived discrimination attributed to race, perceived discrimination attributed to non-racial attributes, and multimorbidity.

2. Does the association between perceived discrimination and multimorbidity vary by race/ethnicity?

It is hypothesized that the association between perceived discrimination and multimorbidity will be stronger among Black and Hispanic respondents relative to the association for White respondents.

RESEARCH DESIGN AND METHODS

Data Source

Conducted by The Survey Research Center at the University of Michigan's Institute for Social Research, The Health and Retirement Study (HRS), is a longitudinal project sponsored by the National Institute on Aging and the Social Security Administration. Beginning in 1992, the study is comprised of baseline and continuous biennial interviews and data collection and currently consists of approximately 20,000 American study participants that are over age 50. Every six years, the HRS enrolls a new cohort, with oversamples of Hispanic and African-American citizens, in order to maintain a steady state representation of the U.S. middle-aged and older population.³⁸

HRS data is publically available and covers a wide range of topics, including: health status, income and assets, employment status and history, family structure, healthcare accessibility, utilization and costs, psychosocial experiences attitudes, cognitive and physical performance based testing, demographic features, housing, access to services and services use, biological data, and more.³⁸

Questions about perceived discrimination are collected in the Leave-Behind Questionnaire (LBQ), a supplemental paper survey left for core HRS participants who complete face-to-face interviews to complete on their own. It captures information about social, psychological, historical, and contextual dimensions. Beginning in 2006, the LBQ was fielded in each biennial wave to a rotating, random sample of 50% of HRS participants who completed the in-person interview during that wave.

Study Population

This study used data from 3 waves of the HRS: wave 12 conducted in 2014, wave 13 (2016), and wave 14 (2018). A pooled sample of respondents who completed the LBQ in 2014 and 2016 (random samples A and B respectively) was used to assess perceived discrimination and the respective core biennial data (2016: random sample A; and 2018: random sample B) was used to assess multimorbidity. This study was restricted to respondents who: identified their race/ethnicity as Non-Hispanic White, Non-Hispanic Black, Non-Hispanic other, or Hispanic; and had valid responses on questions regarding the variables used in this study.

Exposure: Perceived Discrimination

There are two exposures for this study, perceived general discrimination and perceived attributed discrimination. In the HRS Leave-Behind Questionnaire, perceived discrimination is self-reported and measured with the 6-item Everyday Discrimination Scale (EDS) to assess unfair treatment in everyday situations and includes a follow-up question querying attribution. Participants were asked how often they: (1) experienced treatment with less courtesy or respect than other people; (2) received poorer service than other people at restaurants or stores; (3) people act as if they think you are not smart; (4) people act as if they are afraid of you; (5) you are threatened or harassed; and (6) received poorer service or treatment than other people from doctors or hospital. Response categories included: 1=almost every day, 2=at least once a week, 3=a few times a month, 4=a few times a year, 5=less than once a year, and 6=never.³⁸ Items were reverse coded and dichotomized for this study as: 0=never experienced discrimination and 1=experienced

discrimination (categories 1-5). Participants were considered to have experienced discrimination if they reported any discrimination.

If discrimination was reported, the participant was asked about attribution of treatment (marking all that apply) to: ancestry or national origin, gender, race, age, religion, weight, physical disability, other aspect of physical appearance, sexual orientation, financial status, or other.³⁸ We created a variable to describe the attribution for the discriminatory experiences: (1) racial (race/ancestry/national origin), (2) non-racial discrimination (gender, age, religion, weight/physical appearance, physical disability, sexual orientation, financial status or other), and (3) no discrimination.

Outcome: Multimorbidity

Multimorbidity, defined in this study as having 2 or more of 8 conditions, was the main outcome variable. All self-reported chronic somatic diseases asked in the HRS data were used to measure multimorbidity. Each answer to a specific diagnosis was prompted by “Has a doctor ever told you that you have...” with options being: heart disease (including myocardial infarction, coronary heart disease, angina, congestive heart failure, or other heart problems), hypertension, stroke (excluding transient ischemic attack), diabetes, arthritis, lung disease (including chronic bronchitis or emphysema and excluding asthma), cancer (including any malignant tumors with the exception of skin cancer), and psychiatric conditions (including emotional, nervous, or psychiatric problems).³⁸ The total number of conditions was created by summing across all conditions.

Multimorbidity was categorized as: 0-1 conditions; 2-3 conditions, and 4 or more conditions.

Covariates

Informed by previous studies, numerous sociodemographic and behavioral lifestyle covariates were accounted for, some using HRS/RAND variables as is and some using intentional recodes. Sociodemographic covariates include race/ethnicity (Non-Hispanic white, Non-Hispanic black, Non-Hispanic other (race not identified), and Hispanic), age (measured continuously), sex (male or female), educational attainment (number of school years completed recoded into: less than high school (less than 12 years of education), high school diploma/GED received (12 years of education), and education past high school (12+ years of education)), household income (measured continuously); and marital status (married/partnered or not married/partnered at time of interview). Behavioral lifestyle covariates included BMI (continuous measurement recoded into normal weight, overweight, obese, and missing, given the significant amount of study participants with missing BMI information); health insurance status (insured/uninsured; dependent on type/amount of coverage at time of interview); smoking status (never smoked/former smoker/current smoker (at time of interview)), and physical activity status (active/inactive; of note, because of the way the variable was categorized, there is a very small percentage of study participants that reported never participating in light, moderate, or vigorous physical activity in any capacity).

Analysis

Analyses were conducted to assess the association between perceived discrimination, race, and multimorbidity. Descriptive statistics were used to summarize characteristics of the study population. Specifically, categorical variables were assessed using frequencies and percentages and continuous variables that were normally distributed were assessed using means and standard deviations. Bivariate analyses were completed to assess differences in the distribution of the study characteristics; chi-square tests were employed for categorical variables and t-tests were used for continuous variables.

Multinomial logistic regression was used to fit models to examine the association between perceived discrimination (e.g., general discrimination and racial discrimination) and multimorbidity. Odds ratios (OR) and 95% confidence intervals (CIs) were obtained. Models for multimorbidity were constructed sequentially adjusting for: age and gender (Model 1); Model 1 + educational attainment, household wealth, marital status, BMI, health insurance, smoking, status, physical activity status (Model 2). To test whether the association between perceived discrimination and multimorbidity varied by race/ethnicity, an interaction term was added in the fully adjusted model (Model 2). All analyses were conducted using SAS and accounted for the complex sampling design of the survey.

RESULTS

Descriptive Characteristics of Study Population

Descriptive demographic statistics for the study variables are outlined in Table 1. After implementing exclusion criteria, this study included 12,250 participants. The mean age of participants across waves was 69.1 years. The majority of participants identified as female (59.4%) and non-Hispanic White (66.9%). Other racial/ethnic break downs for respondents are as follows: 17.3% Non-Hispanic Black, 12.2% Hispanic, and 3.6% Non-Hispanic other. Considering educational attainment, the majority of respondents had earned more than a high school degree (51.8%), followed by high school diploma/GED attainment (33.8%), and less than a high school diploma or GED (14.4%). The mean income of all included study respondents was \$74,480.77. The majority of participants were married or partnered (61.8%) and the rest, 38.2%, were not currently married/partnered at the time of data collection. In regards to BMI, more than two-thirds of the study population identified as being overweight (33.3%) or obese (36.5%). Underweight and normal weight were grouped together and collectively accounted for 20.9% of the study population. The majority of participants (96.7%) had some form of healthcare coverage while 3.3% did not. Forty-five percent of the respondents had never smoked, 40.1% had formerly smoked and were not currently smoking at the time of their HRS interview (40.1%) and 13.2 percent identified as current smokers. Considering physical activity, 97.7% of the study population was categorized as ‘physically active.’

*Participant Characteristic Distribution by Type of Perceived
Discrimination*

Table 2 displays study participant characteristics by reports of perceived discrimination and attributed reason for discrimination (i.e., racial and non-racial). Overall, 7,686 (62.7%) study participants reported having experienced perceived general discrimination throughout their lifetime; the average age of participants who experienced discrimination was 67.9 years, which was slightly younger than the mean age of those who did not (71.2%). The average annual income for respondents who reported discrimination was \$76,898.91, which is slightly higher than that of respondents who did not report discrimination (\$70,415.78). There are racial/ethnic differences in the proportions of those who have experienced discrimination and those who have not. Reports of perceived general discrimination were most common among Black participants (68.4%) and participants who identified as other (73.3%). Additionally, a higher percentage of male participants reported perceived general discrimination (65.3%) compared to females (61.0%), as well as those who had educational attainment beyond that of high school (66.1%) (compared to less than high school, 53.5%), and those who were overweight (61.6%) and obese (63.8%) (related to normal weight (58.4%). Differences in health insurance status showed significance with uninsured participants more likely to report perceived general discrimination (69.4% for those without insurance compared to 62.5% for those with insurance). Cigarette smokers were also more likely to report perceived general discrimination (68.8%) in comparison to former

smokers (63.0%) and those who had never smoked (60.8%). All covariates showed statistical significance at $p < .05$ besides marital status and physical activity status.

Approximately 15.5% of study participants reported experiencing racial discrimination and 38.7% non-racial discrimination. The average ages of participants who experienced racial discrimination and non-racial discrimination were 64.8 and 68.4 years, respectively. The average annual income of those reporting racial discrimination was \$59,662.28 compared to an average of \$79,943.41 among those who reported non-racial discrimination. Racial/ethnic differences exist in the proportions of those who have experienced both racial and non-racial discrimination. Reports of racial discrimination were most common among black participants (46.2%) and participants who identified as “other race” (36.2%). Approximately one quarter of Hispanic participants (25.6%) reported racial discrimination and only 4.6% of white participants reported racial discrimination. Conversely, white participants reported non-racial discrimination more than any other racial group (46.7%), followed by “other race” participants (33.3%), Hispanic participants (25.1%) and black participants (19.1%).

Participant Characteristic Distribution by Multimorbidity

Table 3 displays the distribution of participant characteristics by multimorbidity categories. Approximately 46.8% of study participants reported 2-3 chronic conditions and 25.0% of study participants reported 4 or more. Racial ethnic differences exist in the proportions of those with multimorbidity and the number of accumulated chronic conditions. More Black participants reported having 2-3 chronic conditions (48.1%) and 4 or more chronic conditions (28.1%)

than any other racial group. Following sequentially, 47.3% of white participants reported 2-3 chronic conditions and 25.0% reported 4 or more chronic conditions and 44.6% of Hispanic participants reported 2-3 chronic conditions and 21.9% reported 4 or more chronic conditions. Average age increased with each increase in number of chronic conditions; the average age of those reporting 0 or 1 chronic condition was 64.2 years, the average age of those reporting 2-3 chronic conditions was 70.1 years, and the average age of those reporting 4 or more chronic conditions was 72.8 years. More females reported higher accumulations of chronic disease with 47.4% reporting 2-3 chronic conditions and 25.4% reporting 4 or more compared to 45.9% and 24.4% of males respectively.

Association between Perceived Discrimination, Attributed Reason for Discrimination, and Multimorbidity

Results of the multinomial logistic regression analyses for perceived discrimination and multimorbidity are provided (Table 4). In minimally adjusted models, reporting perceived discrimination was associated with higher odds of reporting 2–3 chronic conditions (OR 1.34, 95% CI: 1.21, 1.49) and 4 or more chronic conditions (aOR 1.61, 95% CI: 1.43, 1.81). In fully adjusted models the association between perceived general discrimination and multimorbidity remained for those reporting 2–3 chronic conditions (OR 1.33, 95% CI: 1.20, 1.47) and 4 or more chronic conditions (aOR 1.62, 95% CI: 1.43, 1.83). Black respondents had a greater odds of reporting 2-3 chronic conditions (aOR: 1.37, 95% CI: 1.18, 1.58) and 4 or more chronic conditions (aOR: 1.46, 95% CI: 1.23, 1.73) relative to White respondents.

Results of the multinomial logistic regression analyses that examine perceived attribution for discrimination and multimorbidity are provided (Table 5). In the fully adjusted models, those who reported racial discrimination (aOR: 1.25; 95% CI: 1.06-1.47) and non-racial discrimination (aOR: 1.45; 95% CI: 1.30 -1.62) had higher odds of reporting 2-3 chronic conditions in comparison to those who reported no discrimination. A similar relationship was observed where those reporting racial discrimination (aOR: 1.67; 95% CI: 1.38-2.03) and non-racial discrimination (aOR: 1.80; 95% CI: 1.58-2.06) had higher odds of reporting 4 or more chronic conditions in comparison to those who reported no discrimination. We continue to observe that Black respondents had a higher odds of reporting 2-3 chronic conditions (aOR: 1.41, 95% CI: 1.20, 1.66) and 4 or more chronic conditions (aOR: 1.45, 95% CI: 1.20, 1.75) relative to Whites, even in the fully-adjusted model.

Racial/Ethnic Differences in Perceived Discrimination and Multimorbidity Association

While Black respondents had a greater odds of reporting multimorbidity relative to White respondents, the interaction term in Model 2 that was used to test whether the association between perceived discrimination and multimorbidity varied by race/ethnicity did not show evidence of racial/ethnic differences in the association between perceived discrimination and multimorbidity.

DISCUSSION

The findings from this study show an association between perceived discrimination and multimorbidity among middle-aged and older adults. More specifically, findings show that individuals who report perceived discrimination, regardless of whether this discrimination was attributed to race or other reasons, are more likely to have multimorbidity. While evidence was not found for racial/ethnic differences in this association, in the model that controls for perceived discrimination, Black respondents showed higher odds of multimorbidity.

While this is one of the first studies to assess the association between perceived discrimination and multimorbidity, it is consistent with prior literature examining discrimination and individual health outcomes. General discrimination as well discrimination attributed to specific personal characteristics such as race, age, and/or sex,³⁹ has been associated with increased odds of experiencing cardiovascular disease,³³ depression,⁷ cancer,⁴⁰ asthma,⁴¹ and diabetes.⁴² This study didn't specifically examine the underlying mechanisms through which discrimination influences these individual health outcomes, but other researchers suspect that heightened physiological, psychological, and behavioral responses to discrimination translate into negative effects on health outcomes.^{7,40} A similar mechanism may operate in the association between discrimination and multimorbidity.

The association between perceived discrimination and multimorbidity was largest for those who indicated 4 or more conditions, displaying that discrimination is strongest with the highest severity of chronic condition burden. Racial and non-

racial perceived discrimination were examined separately. Both racial and non-racial discrimination were associated with multimorbidity. A slightly stronger association was observed between perceived attributed non-racial discrimination and multimorbidity when compared to perceived attributed racial discrimination and multimorbidity. In this study, non-racial discrimination included a variety of sources of discrimination including gender, age, religion, weight, physical disability, other aspect of physical appearance, sexual orientation, financial status, or other. Non-racial discrimination encompasses more avenues to chronic stress that can lead to adverse health outcomes.

This study did not find evidence for a racial/ethnic interaction between perceived discrimination and multimorbidity (for “any perceived discrimination” or the variable that considers attribution for the experience of discrimination). While an interaction may not exist, it is possible that not have enough power was available to sufficiently test interactions between perceived discrimination and the four racial/ethnic groups. However, evidence displays that these associations were strongest among blacks. This could be due to the fact that the stressor of discrimination reportedly has a higher burden for black Americans. Today and throughout history, this group has been more likely to experience multiple types of discrimination.

STUDY STRENGTHS & LIMITATIONS

Strengths

This study had several strengths. First, the HRS offers longitudinal data reflecting a wide-range of health, sociodemographic, and patient-reported outcomes generalizable to the population of middle-aged and older adults in the U.S., which made it possible to observe changes in participant reports of chronic disease burden and multimorbidity onset during significant periods of middle to late adulthood. The HRS's prospective design and oversampling of Black and Hispanic populations allowed for assessment of time-sequencing of chronic disease burden and accumulation of multimorbidity and development among adults from various racial groups. An additional strength is the contribution of this study to the literature on the epidemiology of multimorbidity.

Limitations

There were several limitations to this study. First, as there is no set definition for multimorbidity, we chose the 8 chronic conditions used in the HRS to measure multimorbidity, possibly conflicting with findings in other studies. Second, HRS data is self-reported and may result in underreporting/underdiagnosis, leading to inconsistencies and/or inaccurate data. Finally, only Black, White, and Hispanic populations were examined as these racial/ethnic groups comprise the majority of the American population, leaving out those who identify as a different race/ethnicity.

PUBLIC HEALTH IMPLICATIONS

Because multimorbidity is increasingly common as society ages, it is important for researchers and physicians to understand the causes and risk factors for accumulating multiple chronic conditions at once; knowing what leads to multimorbidity can aid in prevention and treatment. While this study highlighted the prevalence and association among perceived discrimination and multimorbidity, examining incidence and progression overtime could provide more insight into the joint processes of morbidity and mortality among racially diverse middle-age and older adults. This study displays that multimorbidity is not only common, but more burdensome for underrepresented racial/ethnic groups in the United States, specifically Black Americans. There is a need for proactive interventions and policies designed to improve healthcare and delay institutionalization for patients with high multimorbidity burden, especially those from minority racial/ethnic backgrounds.

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